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WillisTowersWatson 

JUST.
RETHINK RETIREMENT

Super-healthy mortality

How low can you go?

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Agenda – main concepts

Can we define a super-healthy group from the general population?

What is their mortality?

Does super-healthy mortality tell us anything about when longevity improvements must stop?





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Who are the super-healthy?

13 June 2017

Do actuaries like health?

Improvements

- Studies on improvements have generally been at the population level
- Over the last five or so years there has been increased interest in how improvements vary by socio-economic strata

Base mortality

- Underwriting has generally also looked at broad groups, with segmentation focusing on worse mortality rather than better
- This perspective is also starting to change
 - firms such as Vitality seeking to insure the super-healthy
 - annuity writers segmenting the (probably) very healthy using postcode and annuity amount / final pensionable salary



What can healthy lives tell us?

Base mortality

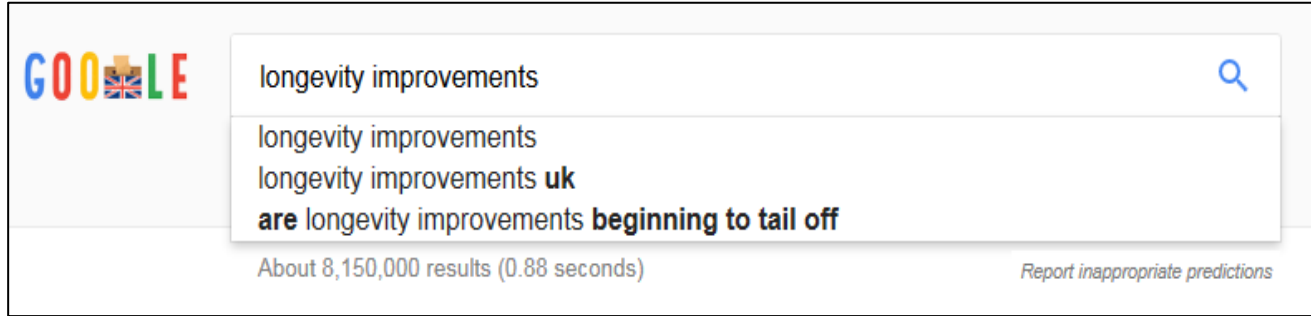
- What can a firm underwriting the healthiest lives safely assume?

Improvements

- Almost all (re)insurers and pension funds assume a constant long-term future improvement rate in projecting longevity improvements (typically 1.25-1.75%)
- What does this imply for our understanding of average life expectancy?
- Is it reasonable for an average person now to become ‘as if’ super healthy today at some future point?



The wisdom of crowds: what does Google tell us?



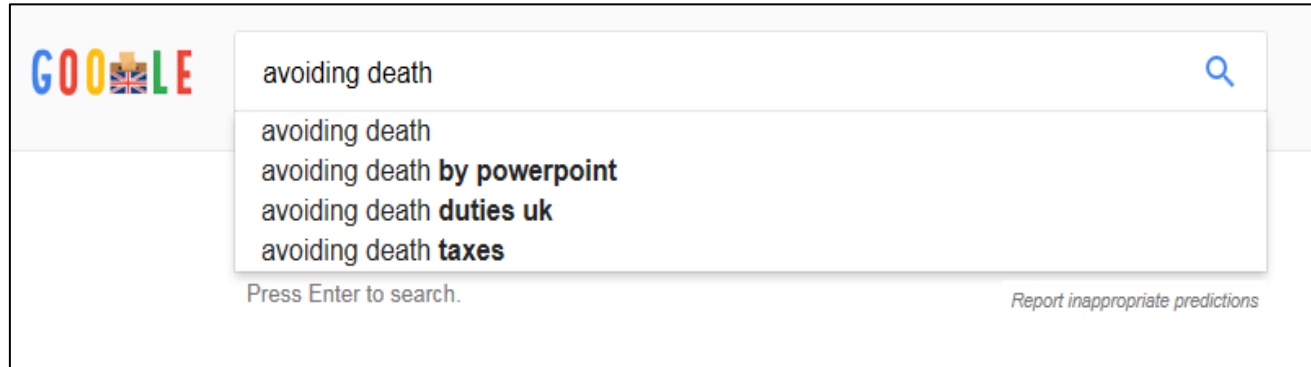
GOOGLE

longevity improvements

longevity improvements
longevity improvements **uk**
are longevity improvements **beginning to tail off**

About 8,150,000 results (0.88 seconds)

[Report inappropriate predictions](#)



GOOGLE

avoiding death

avoiding death
avoiding death **by powerpoint**
avoiding death **duties uk**
avoiding death **taxes**

Press Enter to search.

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Objectives of the improvement analysis

- Construct a life table of annual mortality by age for males with no significant current recorded conditions, no significant medical history, and no significant medication history from ages 40+
- Explore the rate at which population mortality would have to improve before all individuals in the general population experienced the mortality currently experienced by this group
- Compare this rate to the assumptions typically used by insurers (etc)



Clinical Practice Research Database

- Comprises medical treatment information on 21 million anonymised patient lives followed for up to 25 years
- 1.8bn consultations
- 1:12 people in UK
- 600 currently contributing GP practices
- Medical history mostly captured, risk-factors less so
- Data quality varies by time (some lack of consistency pre-2010)



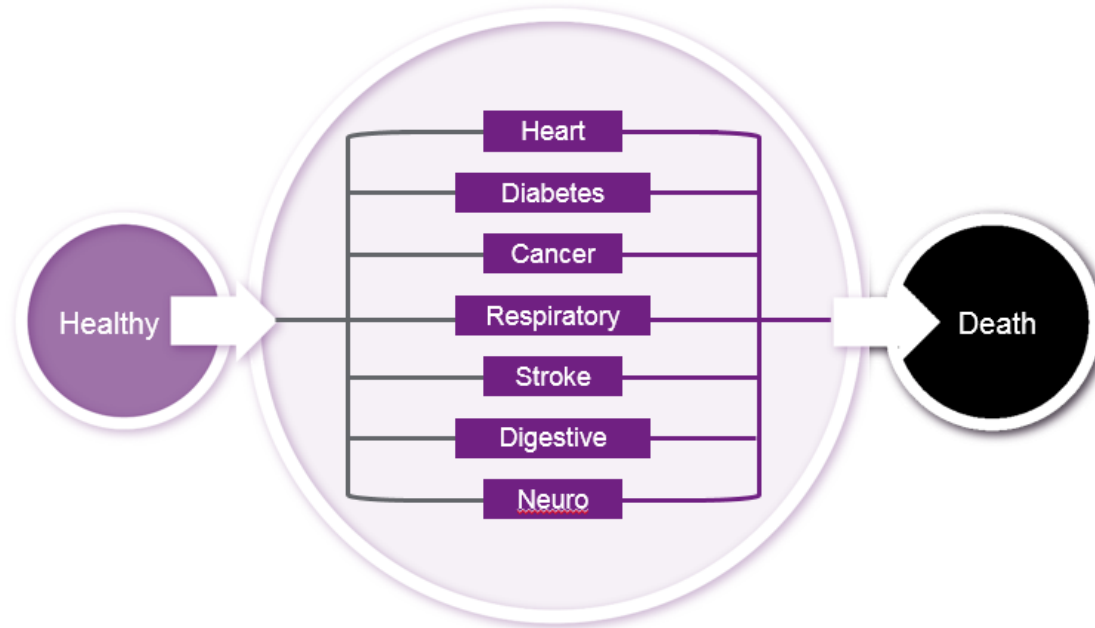


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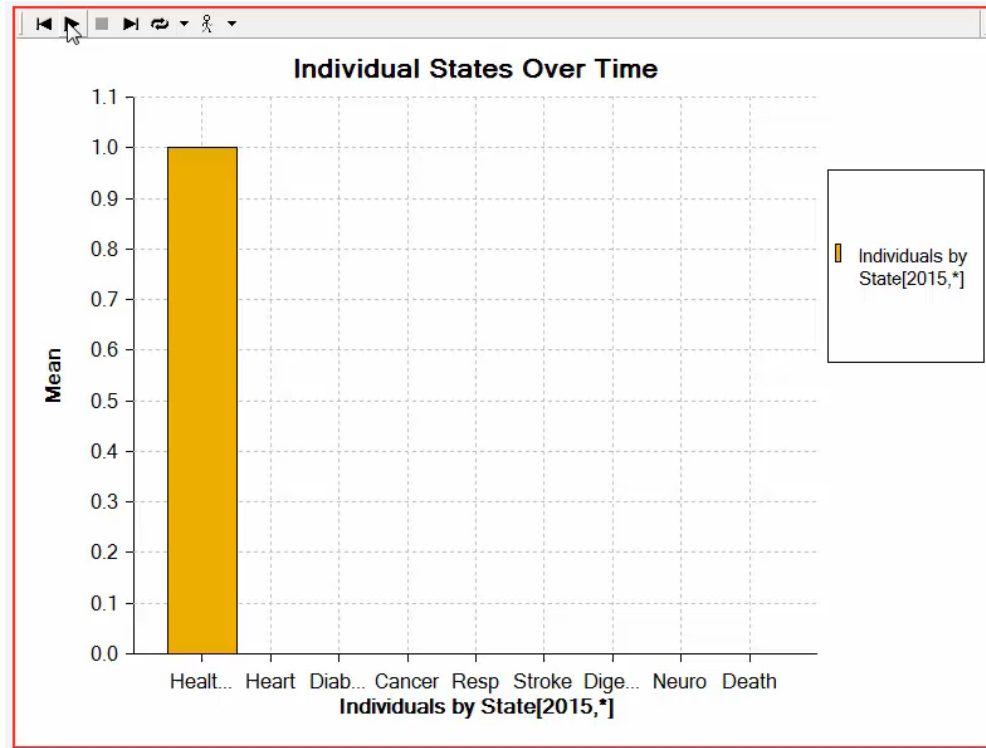
Base mortality

13 June 2017

Methodology



Multistate model mechanics



A healthy hypothesis

- The presence of disease in an adult is clearly a risk factor for mortality
- Adults in the general population with no relevant history recorded in their GPs' medical records are likely to be drawn from the healthiest group of people alive today
- Those adults will differ in terms of their risk factors for mortality, so the group will not necessarily be homogeneous
 - In GPs' records, most smokers will have this fact recorded, as will be most people's height / weight
 - Although other lifestyle predictors of longevity, e.g. diet / exercise, not recorded systematically
 - These adults may also differ in diseases that are not recorded in their medical notes
- We can study lives consisting of 'undiseased' non-smokers with other good risk factors
- **For what reasons should people living (say) 100 years from now, who do not have, and have never had, any significant medical history, be living any longer than adults in this group who are alive today?**



Selection criteria for our super-healthy group

- Absence of
 - Heart disease, stroke
 - Diabetes
 - Cancer
 - Respiratory disease
 - Neurological disease
 - Other major conditions (eg IBD, kidney disease)
- NB we also mean absence of *any history* of these conditions
- Presence of
 - Good HbA1c
 - Good BMI
 - Good socio-economic bracket (via ONS IMD)
 - Good smoking habit (ie never-smoker!)

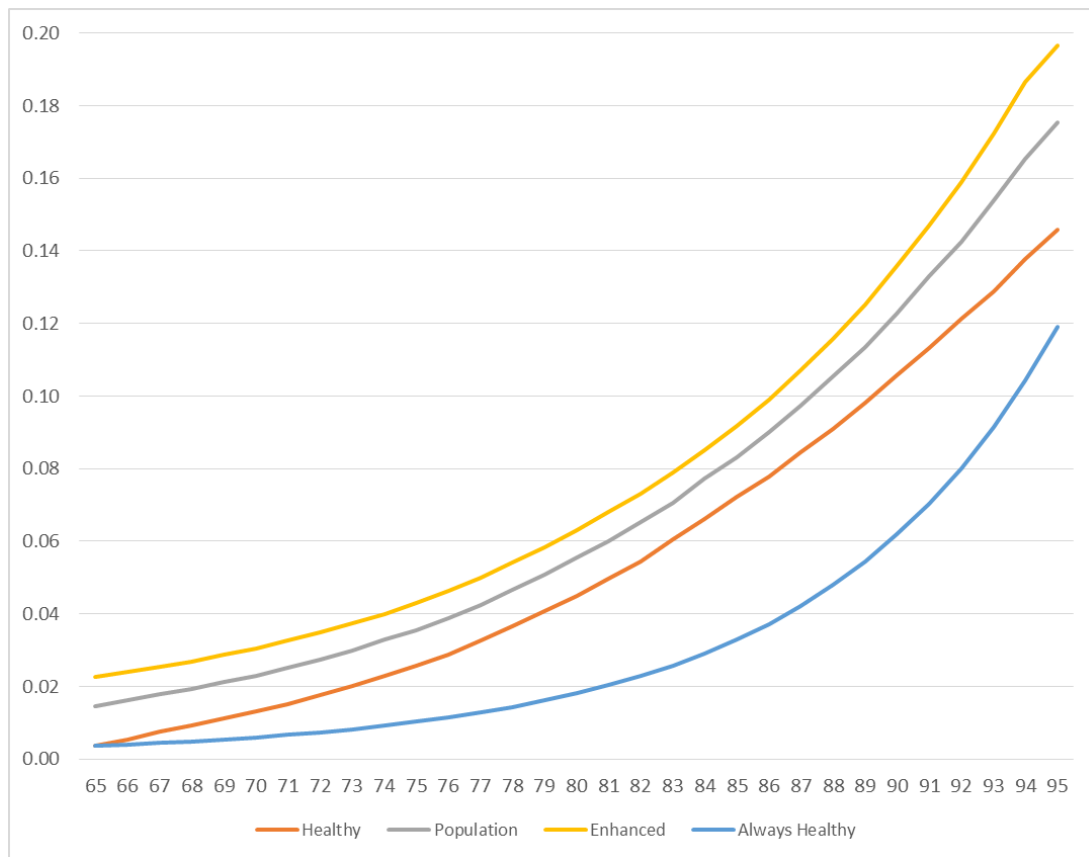
Data volumes: 676,000 man-years exposure from disease criteria, pre-risk factor stratification. Risk factor effects computed from larger data set using GLMs rather than cutting data to create individual 'cells'.



Healthy mortality

We can compare the mortality of the healthy group against population, and also against typical enhanced annuity profile. The relative 'health discount' varies from -75% initially to circa -20% from age 75.

Also as a lower bound we have a 'permanently healthy' life – defined as not having any major conditions at the start of each year

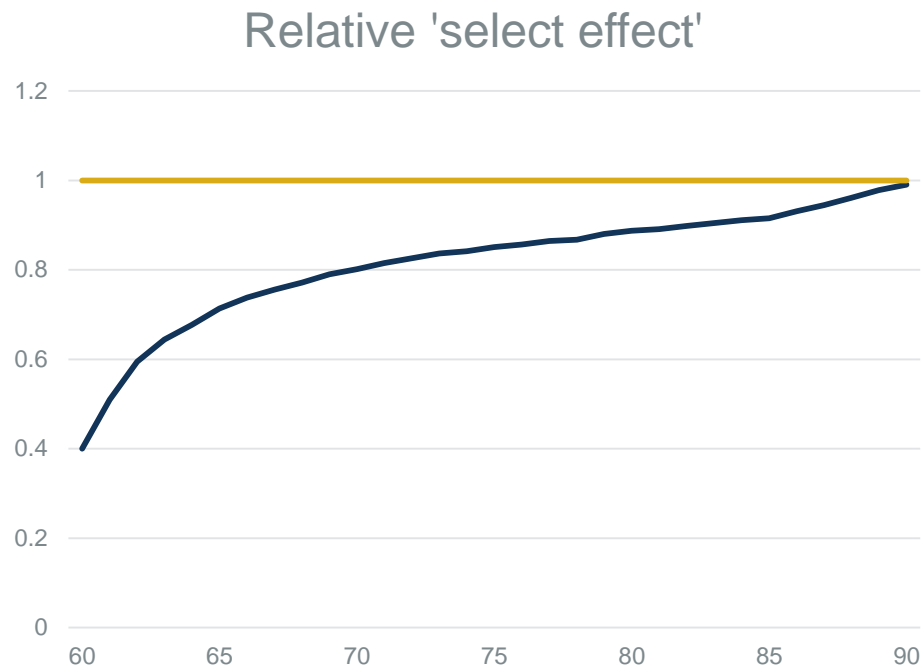


Select effects

Method can be used to compare the mortality of males of identical age, one of whom was known to be **healthy at age 60**, the other was known to be **healthy at age 50**.

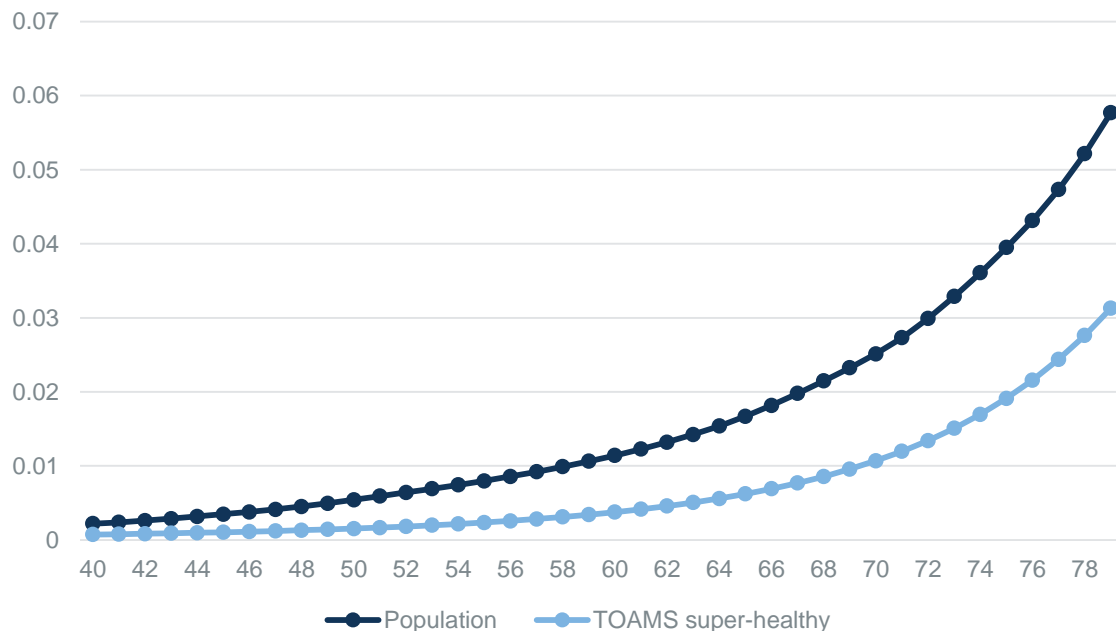
The graph shows mortality of the 'just underwritten' life in black relative to the same life known to be healthy 10 years previously.

The length of the select period is surprising to actuaries used to the 2 or 5 yr select periods of CMI tables.



Healthy mortality – comparison from US

Superhealthy mortality in US v population (2008 males)



Data from Towers Watson Old Age Mortality Study 3, looking at non-smoking preferred lives with highest sums assured.

Mortality = 30% of population initially, rising to around 50% age 79.



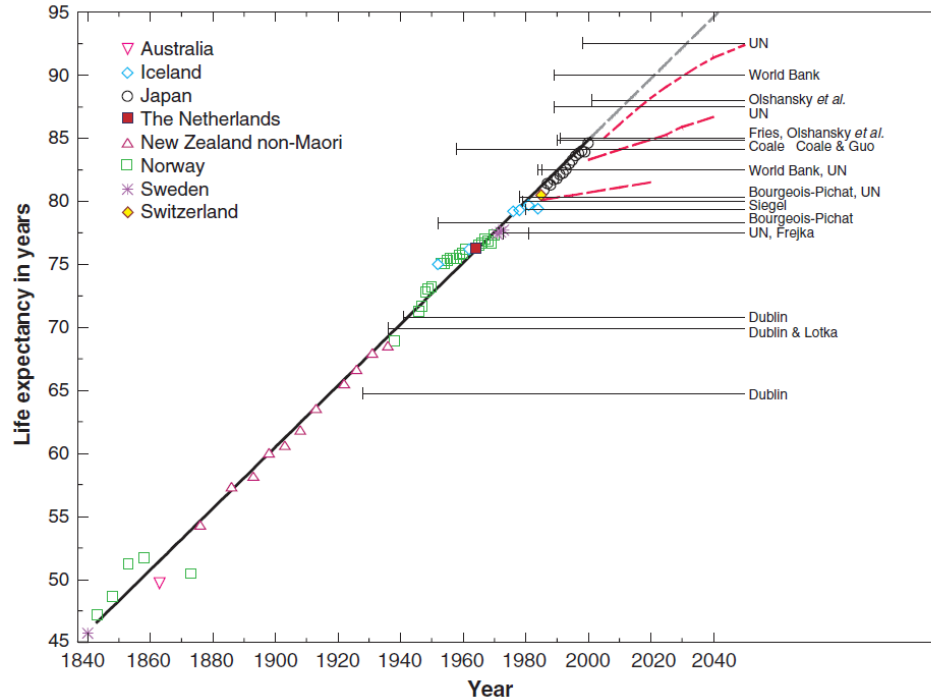
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Context to analysis

Jim Vaupel: Broken limits to life expectancy 2002



Open & Vaupel
Science, 2002



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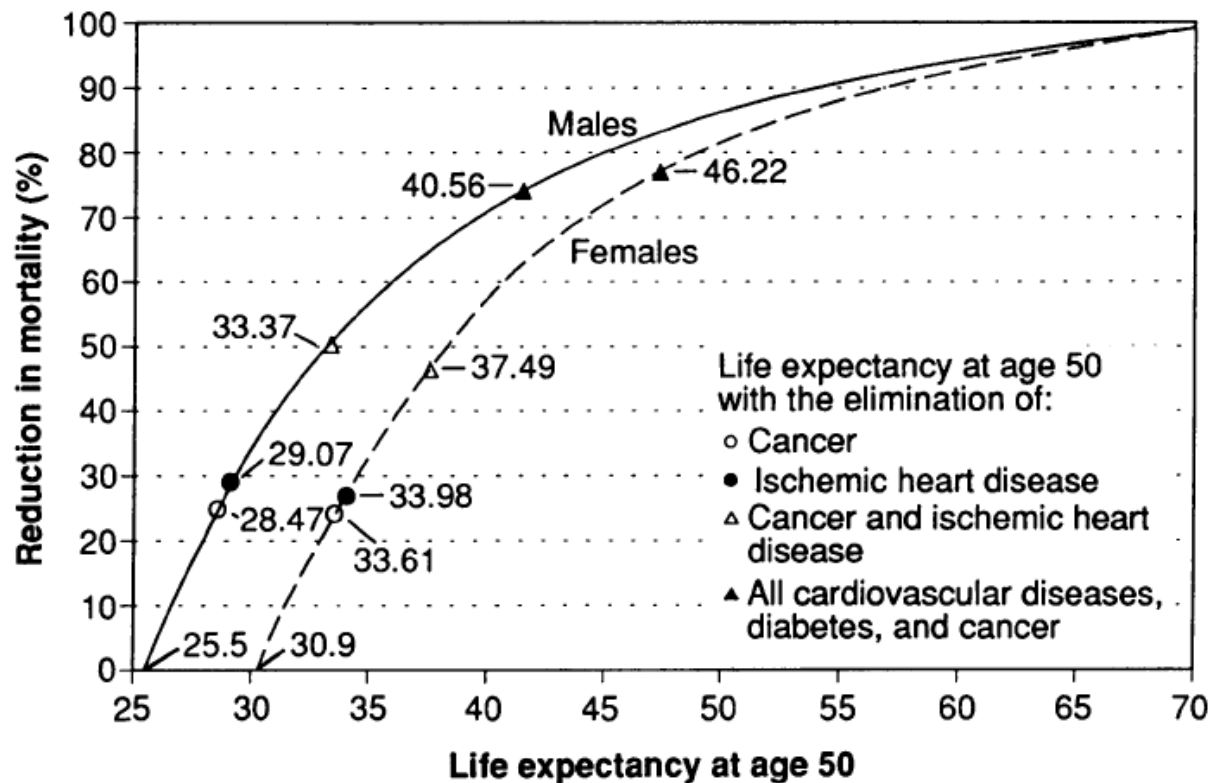


Fig. 3. Percentage of reduction in the conditional probability of death for the United States (from 1985 levels) required to produce a life expectancy at age 50 from 30 to 70 years.

*In Search of Methuselah:
Estimating the Upper Limits to
Human Longevity*
Olshansky et al
Science 1990



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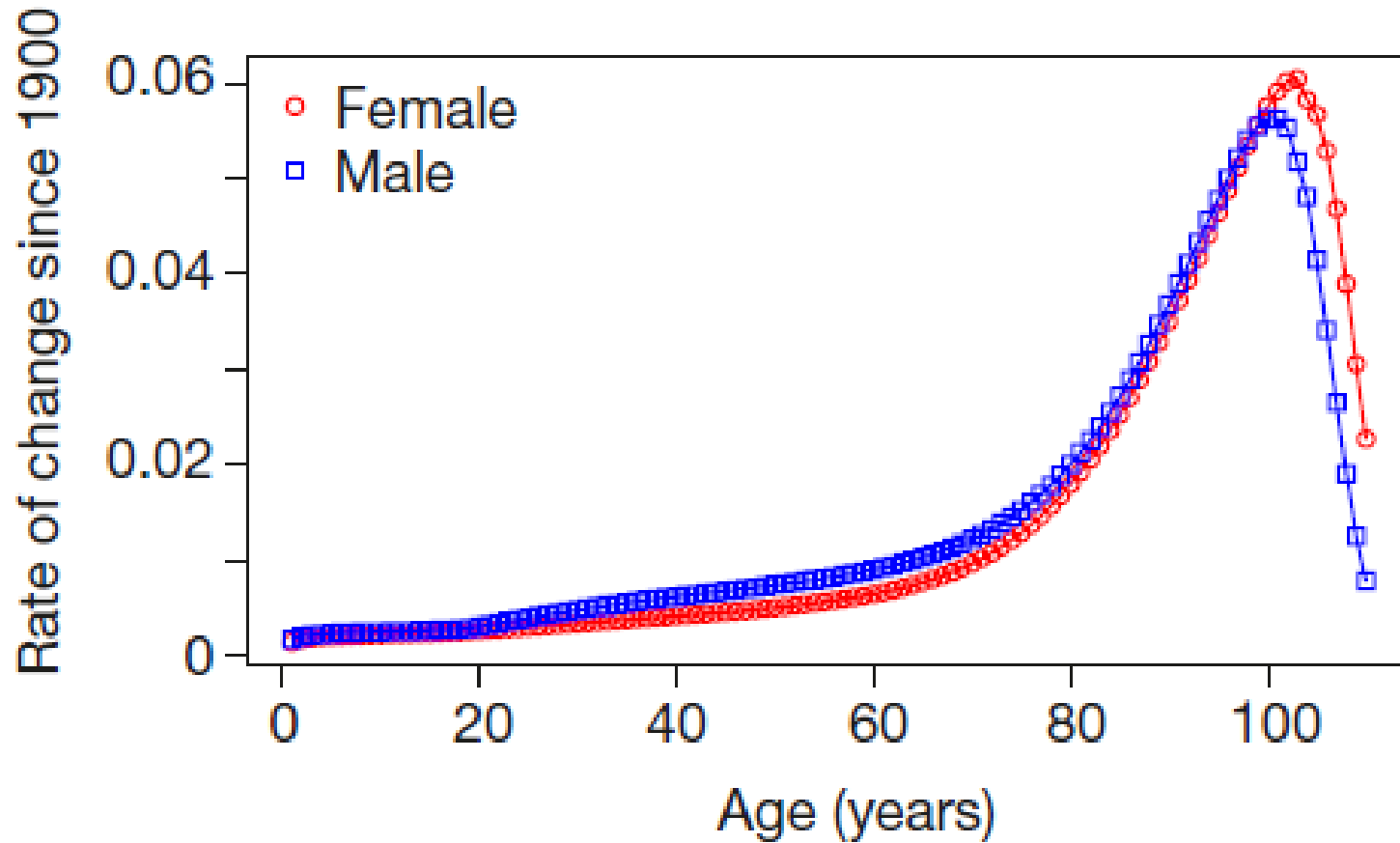


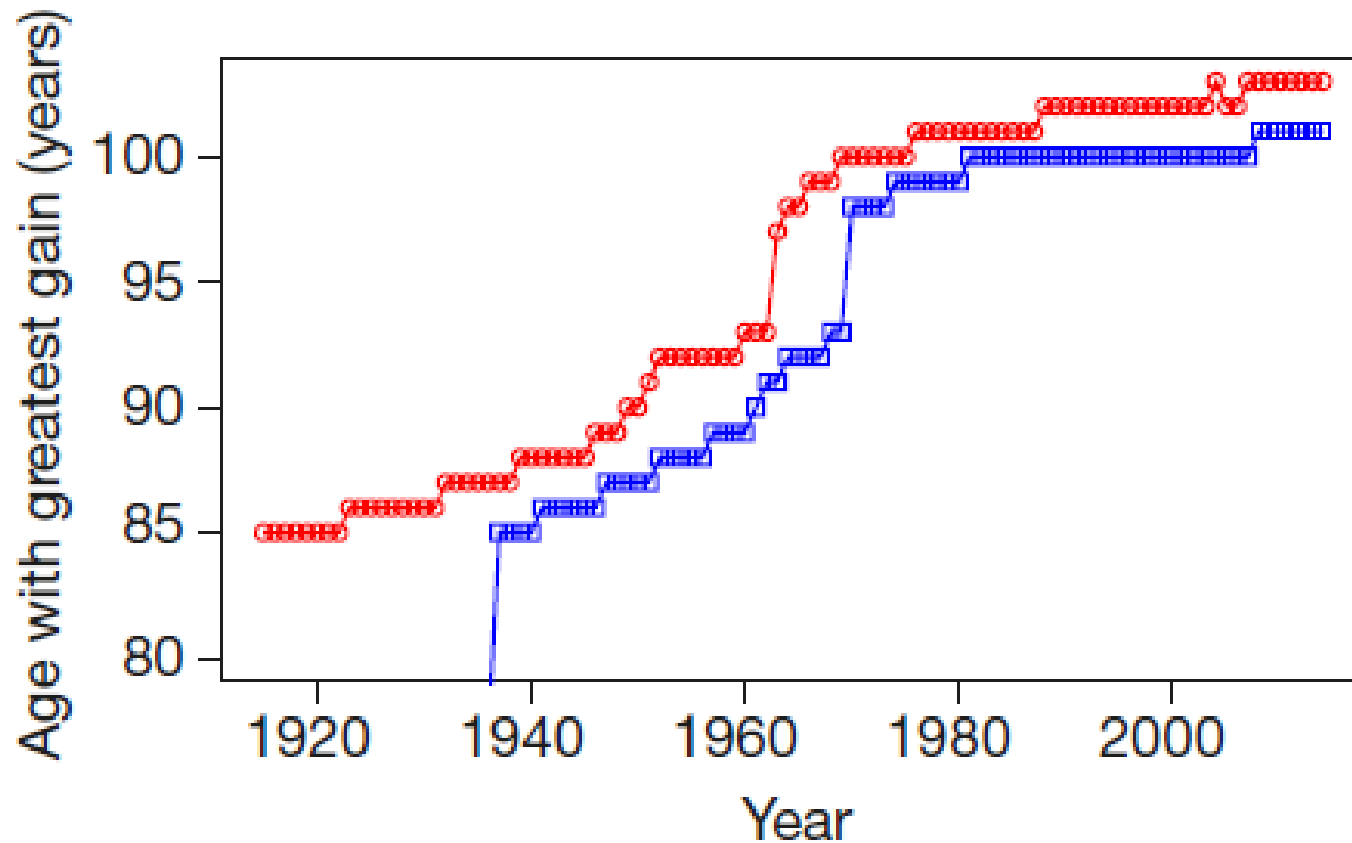
Dong Nature 2016

Average age at death for 554
supercentenarians 1970-2005



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ELT17, the super-healthy table and convergence

How low can you go?

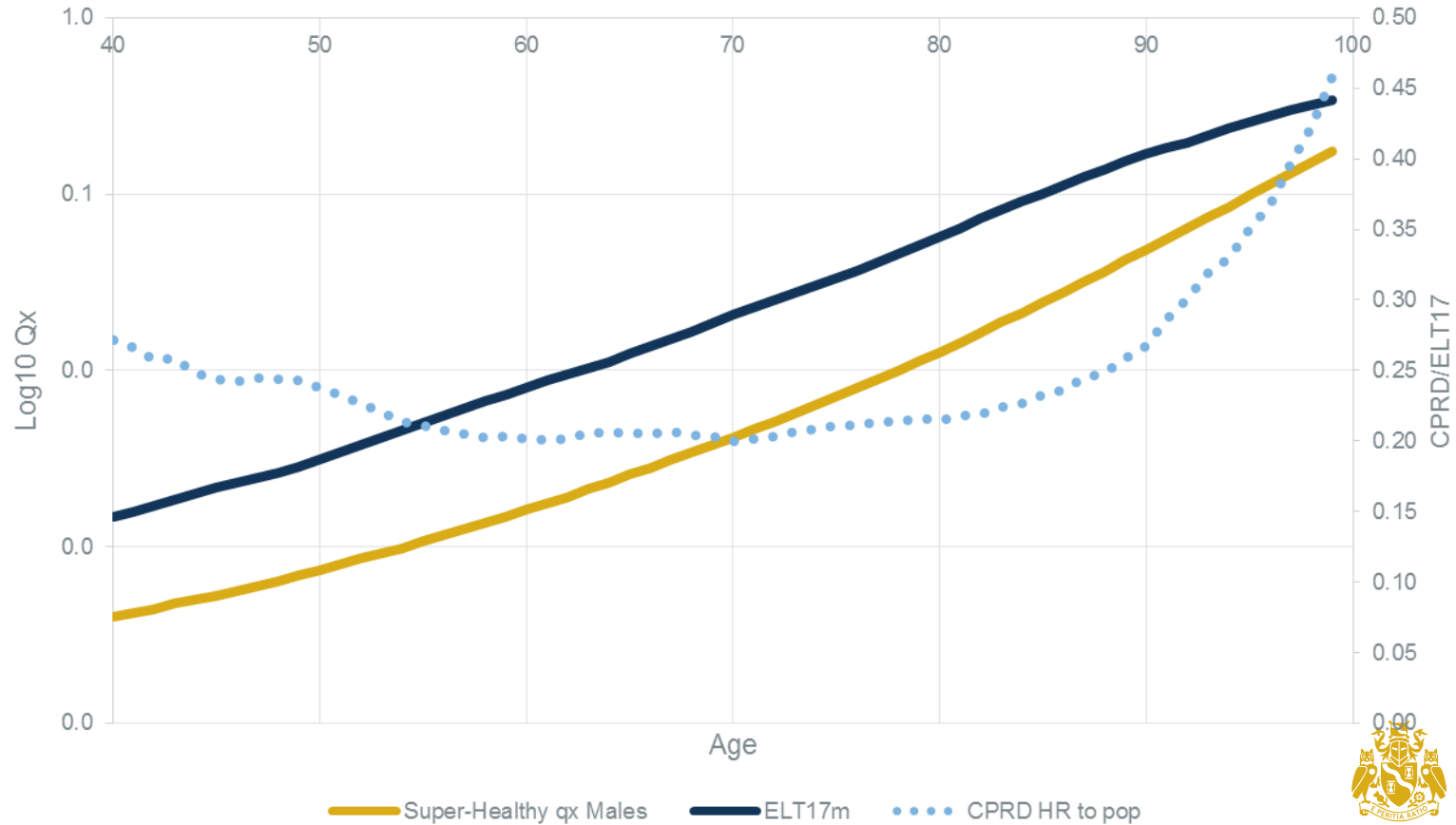


Aim of this section

- Take the CPRD-derived life-table of annual mortality by age for males with no significant current recorded conditions, no significant medical history, and good risk factors (non-smokers etc. as per previous slides) from ages 40+
- Explore the rate at which population mortality (ELT17) would have to improve before all individuals in the general population experienced the mortality currently experienced by this group
- Compare this rate with typical insurer improvement assumptions

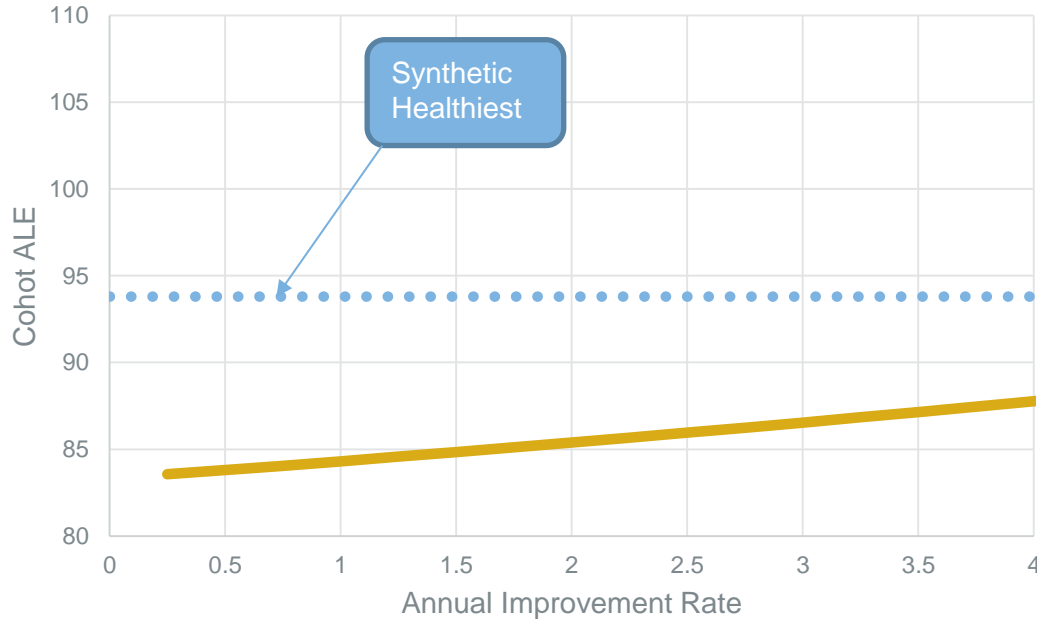


Ratio of Super-Healthy CPRD to ELT17m



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2017



**Cohort ALE from
65 for always
healthy from 2017
under various
long-term
improvement
assumptions**



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+50 years: 2067

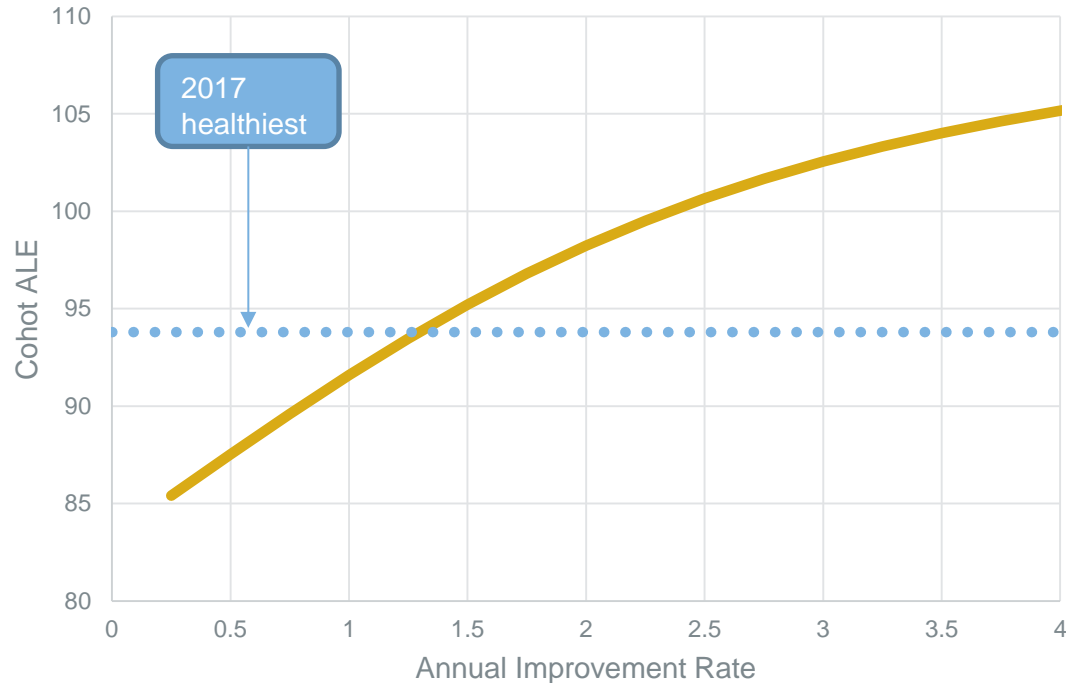


**Cohort ALE from
65 for always
healthy from 2067
under various
long-term
improvement
assumptions**



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+100 years: 2117



**Cohort ALE
from 65 for
always healthy
from 2117 under
various long-
term
improvement
assumptions**



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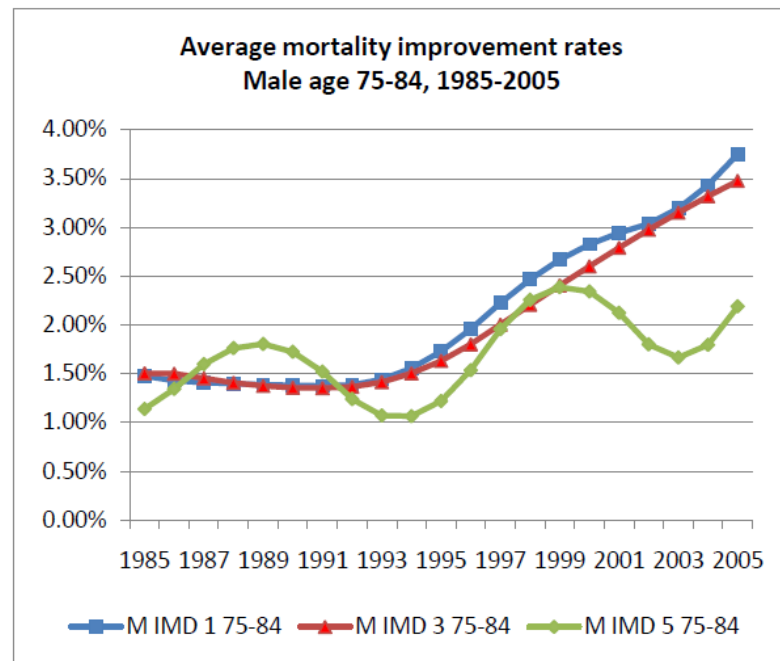
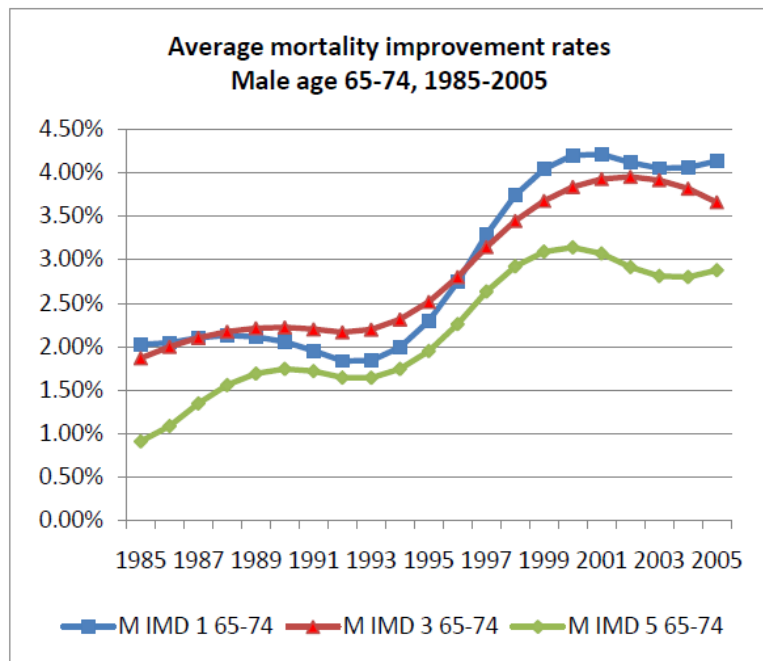
CMI Convergence to synthetic healthiest @ 1.5%

Year when CMI model converges to healthiest	2126
Healthiest LE from CPRD	93.8
Years after 2017 when rates converge	109



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Lu et al – improvements by SEG



Caveat: generalisability of population improvements to healthy people?

- CMI suggestive evidence of **increased** improvements for normal health vs ill-health retirees
- L&G / Barnet Waddingham / Hymans analysis showing higher improvement rates amongst people in higher SEGs
- Suggests that the healthiest people have experienced the highest improvement rates – some assume up to 5% in recent years
- Can this be sustained? Will we see a widening of the longevity inequality

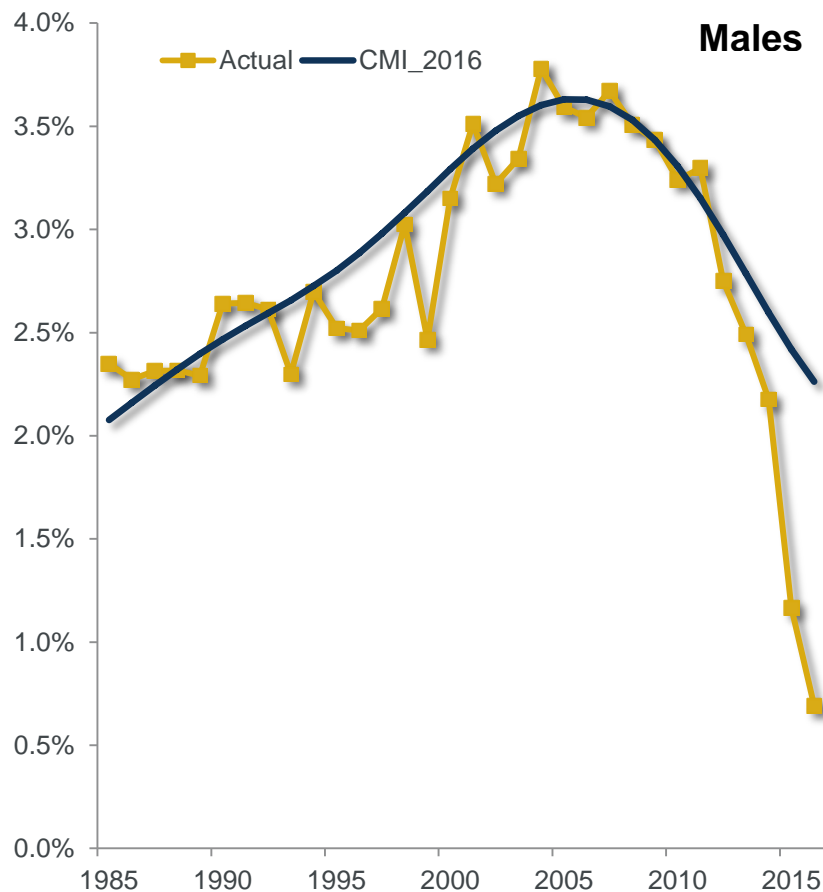




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Reductions in which diseases?

Drivers of reductions in longevity



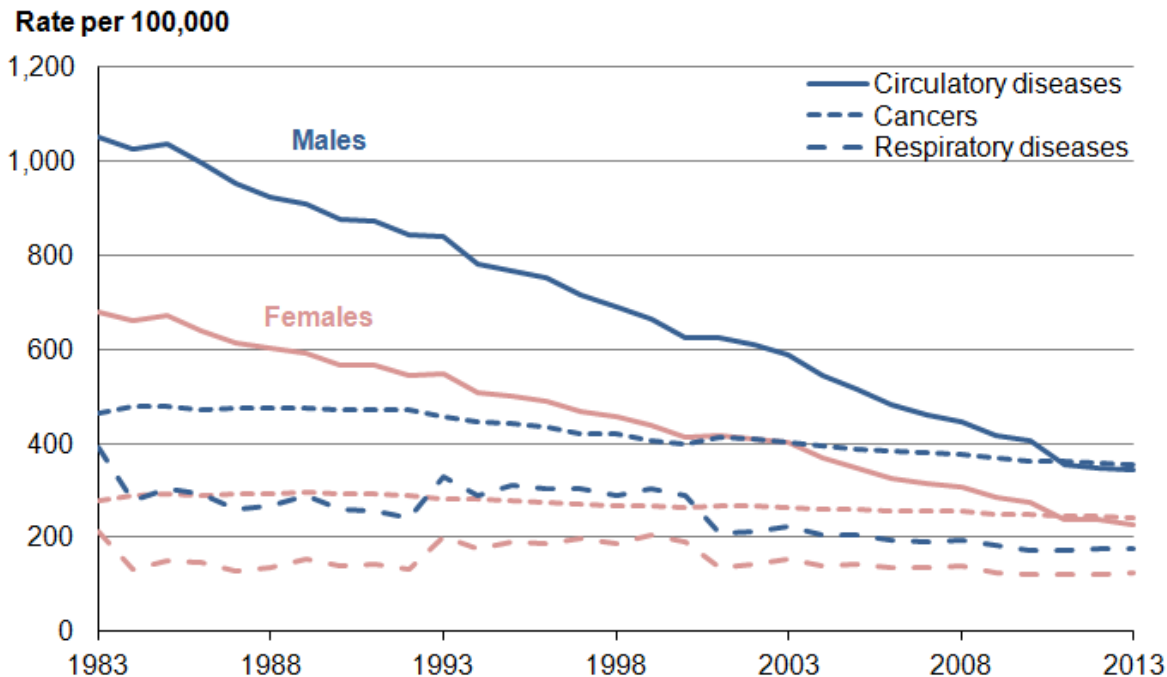
**Average
annual
improvement
rate over
previous 5
years, 1925-45
birth cohort,
England &
Wales**

With thanks to Richard Willets



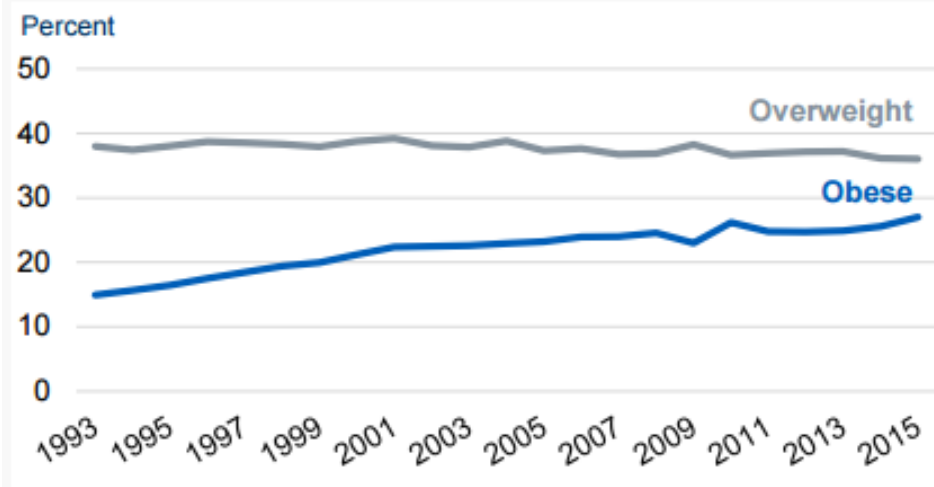
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Cause-specific improvements UK 1983-2013



Obesity

Obesity prevalence increased from 15% in 1993 to 27% in 2015.



- Obesity continues to rise
- Seems relatively constant across socio-economic groups for males
- What would have to happen for people to reverse the trend?



Alcohol – probably getting better?

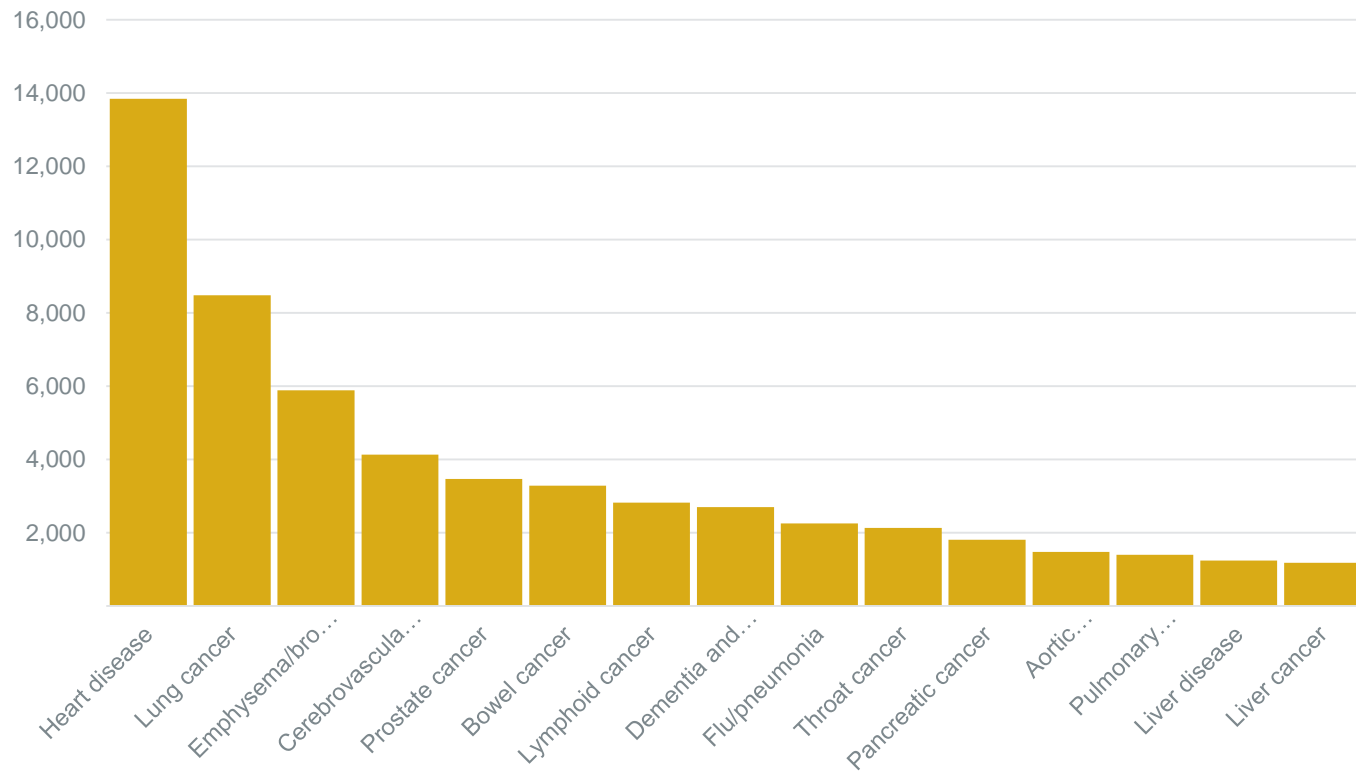
- UK alcohol-related deaths have been broadly static in the last two years of reporting (2013 and 2014 compared with 2012), and circa 10% down from peak 2008 levels.
- Overall the age-standardised mortality rate is around 50% higher in 2014 than it was twenty years previously.

Trends and considerations

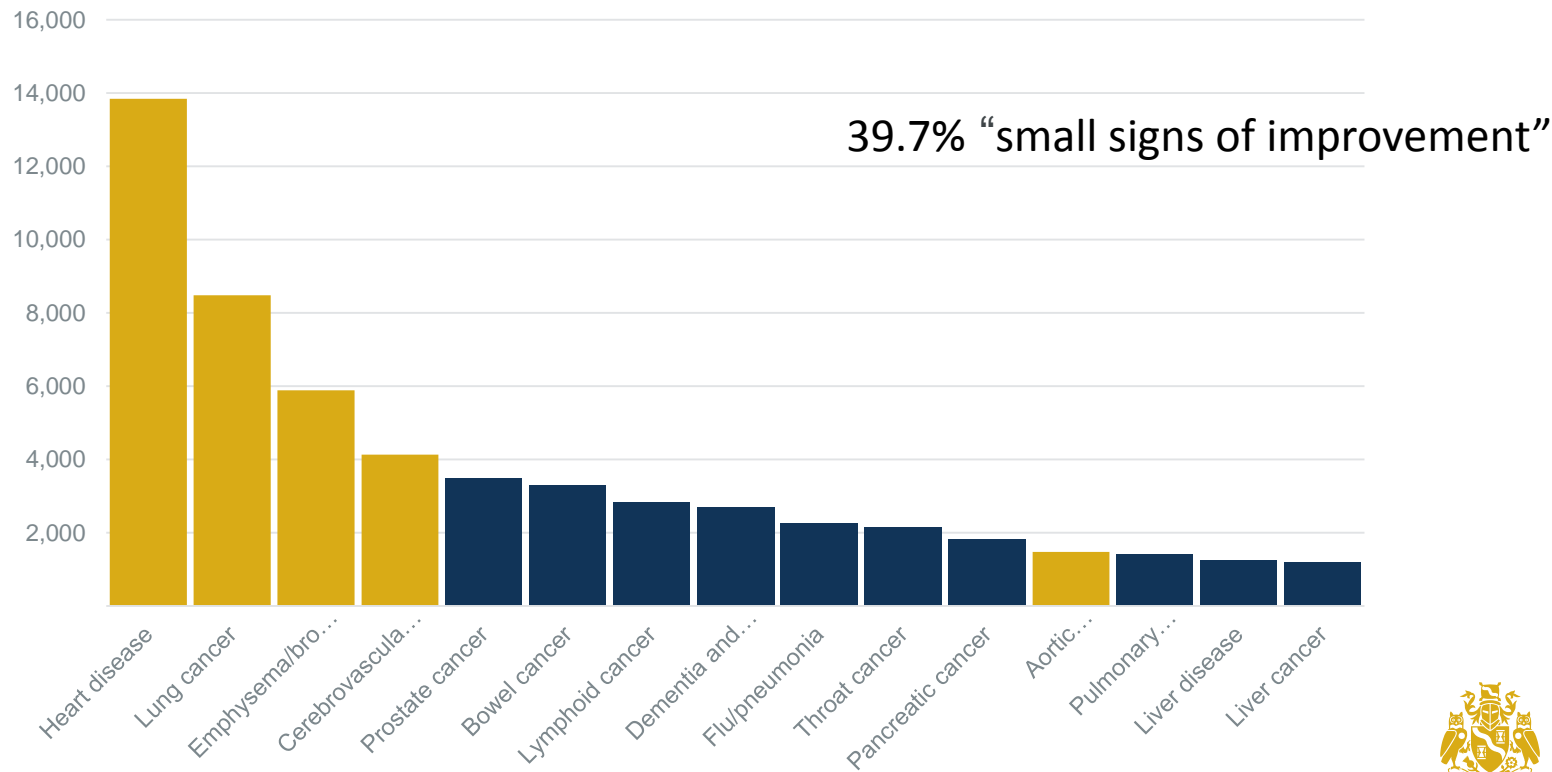
- According to the ONS, researching drinking frequency from 2005-2013:
 - %age of the population having one alcoholic drink in the previous week fell by around 10% (relative), from 64% to 58%;
 - %age of the population having an alcoholic drink in at least five days in the previous week fell by around one-third, from 17% to 11%.
- But ... share prices of the drinks sector have increased by 30% over the last three years (end Jan 2014 to end Jan 2017), around three times the FTSE-100 increase – could imply a very positive outlook for ongoing future demand?



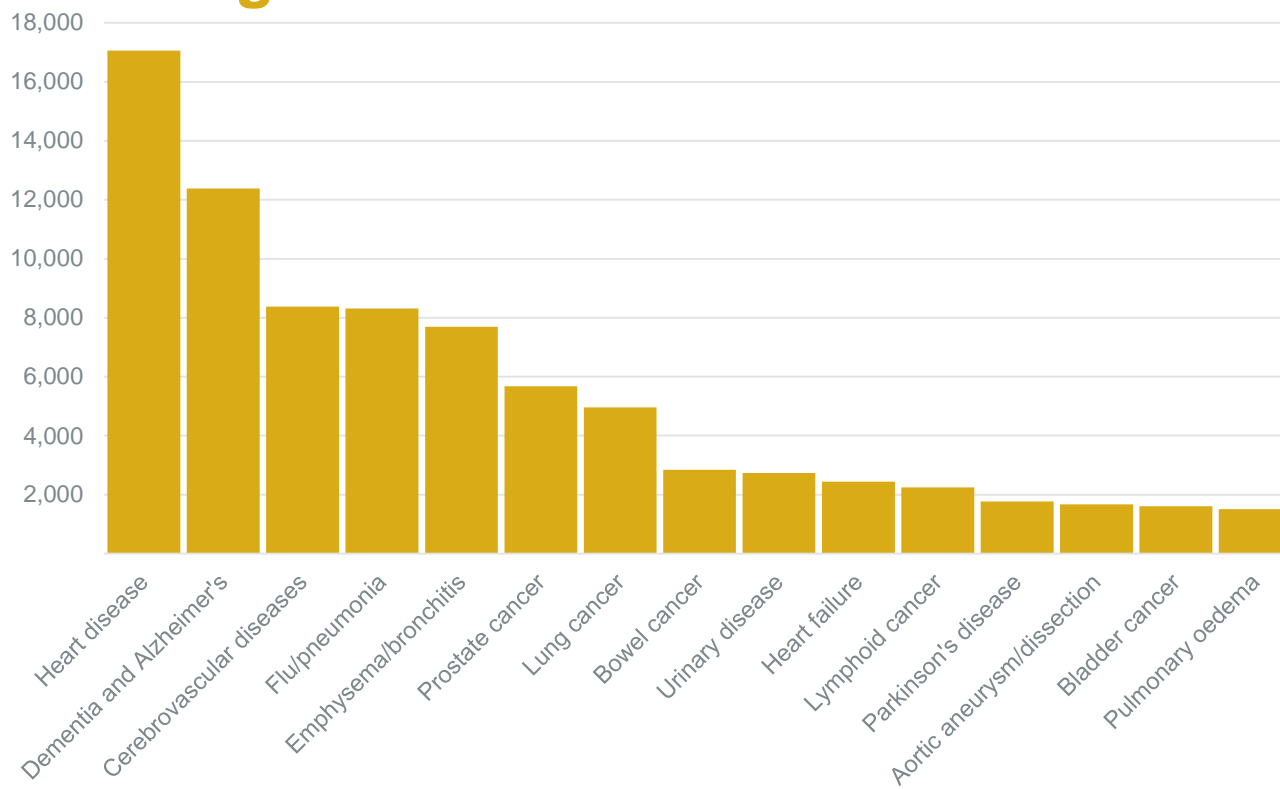
UK Leading Causes of male death 65-79 2014



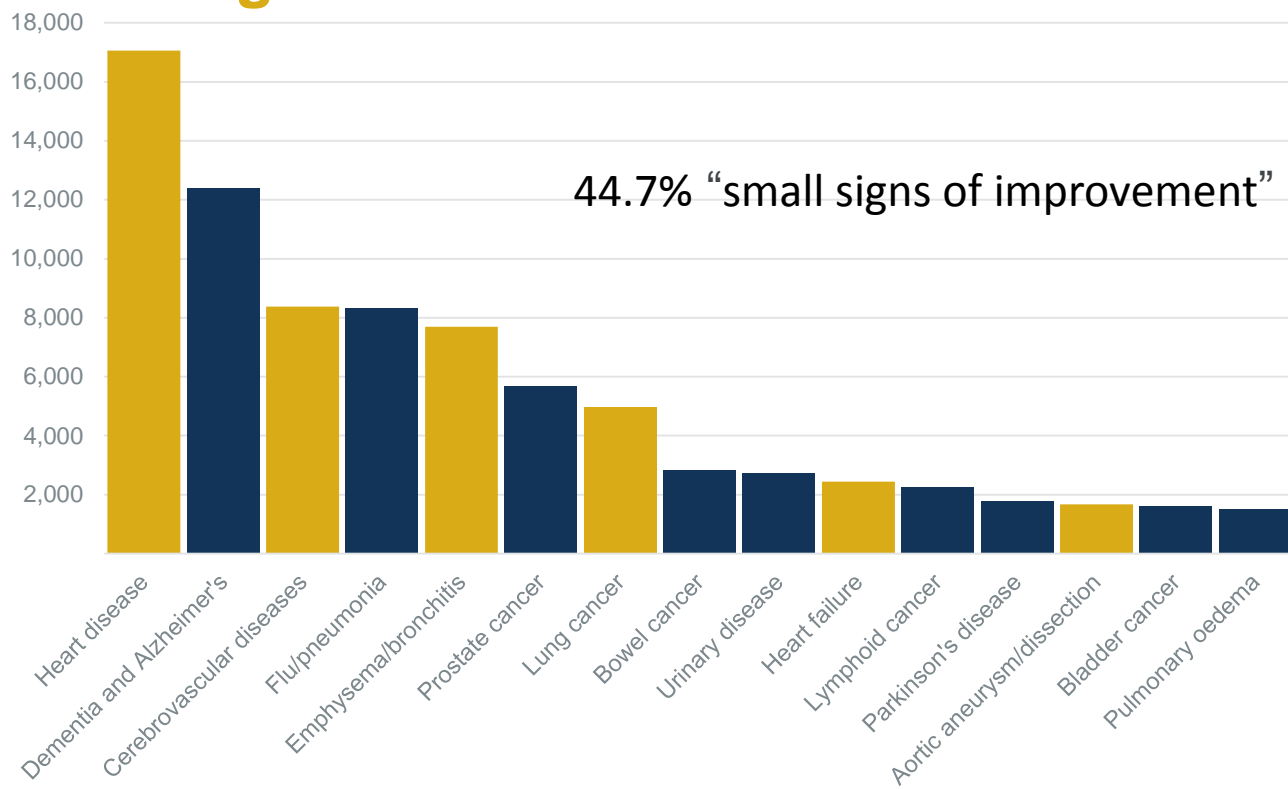
UK Leading Causes of male death 65-79 2014



UK Leading Causes of male death 80+ 2014



UK Leading Causes of male death 80+ 2014



Increase in LE with elimination of Diabetes and all CVD

Pulse Model: what would happen to **period** LE in the average CPRD population with the removal of two major sources of disease?

Age	Population LE	New L.E.	Difference	Increase
40	44.00	45.62	1.62	3.7%
50	34.98	36.33	1.35	3.8%
60	26.43	27.52	1.09	4.1%
70	18.53	19.37	0.84	4.5%
80	11.64	12.22	0.58	5.0%

**Period LE is clearly absent of any assumed improvements*

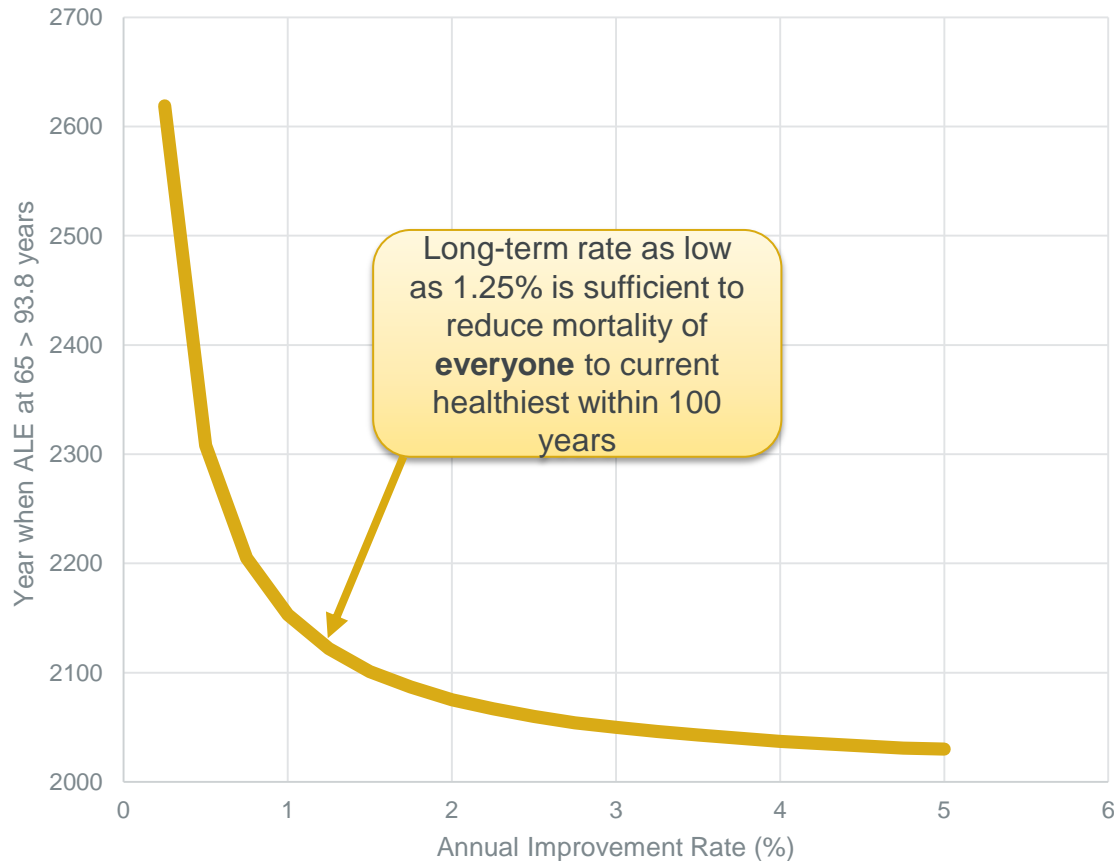


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So what is the healthiest ALE in CPRD?

- Highly synthetic group
- 92.86 at 40 years
- 93.81 at 65 years
- These people have no observable illness at the start of the year, they experience a certain amount of incident disease, and some of them die within this calendar year. This implies the **elimination of chronic diseases** and the **removal of existing medical history** from all people at 65 years
- Their rates of death are typically around 20% of the ELT17 table, increasing from the mid-eighties.





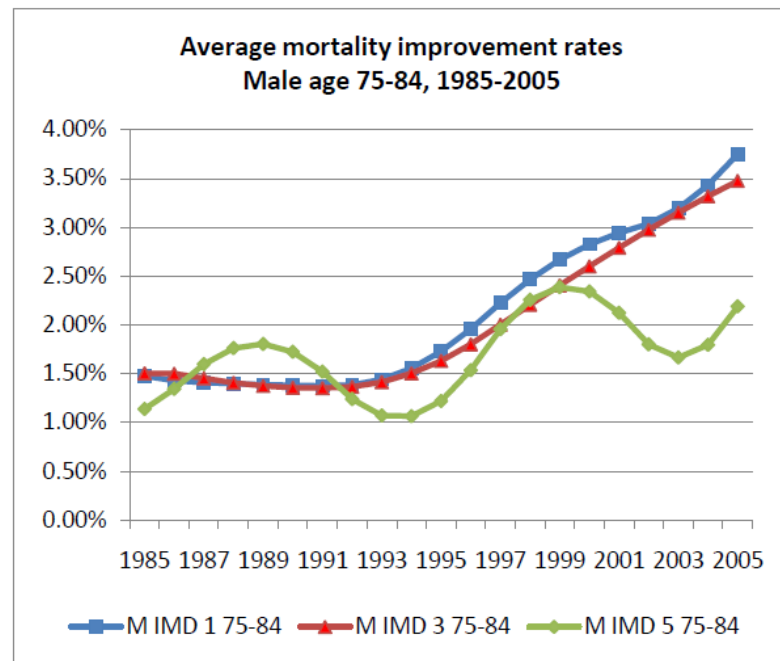
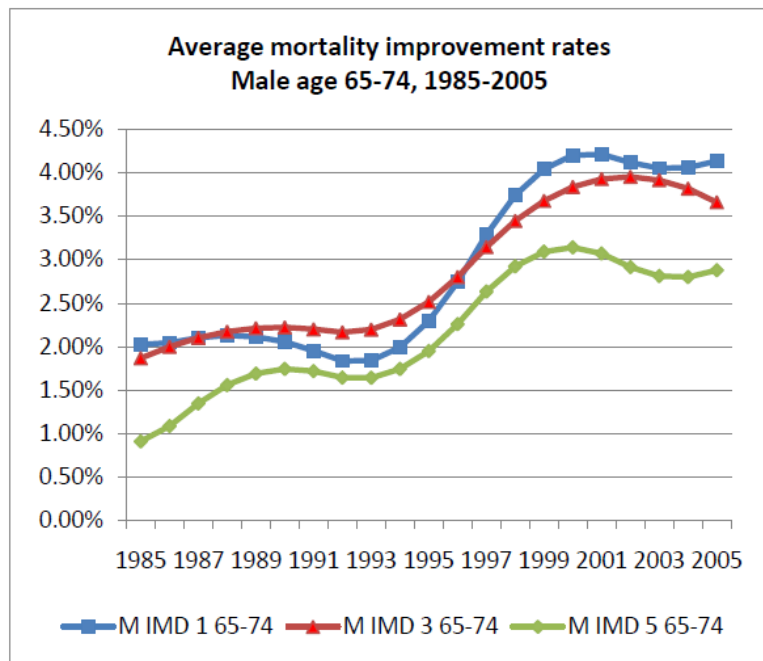
Average annual improvement required for population ALE to reach 93.8 years

Assumes improvements tapering from 85-110 years



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Lu et al – improvements by SEG



What could change for the very healthiest?

- Future incidence of disease?
- Obesity, Diabetes?
- Early uptake of longevity-promoting drugs by the highest social classes?
 - Statins, LDL Vaccine?
 - Metformin?
 - New pharmaceuticals?

The Telegraph

HOME | NEWS

Science

Science

World's first anti-ageing drug could see humans live to 120



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By how much would mortality need to be reduced in the future to take average longevity to...

Average age of death	100 Yrs	120 Yrs
Super-healthy	-50%	-87%
Population	-90%	-99%



Conclusions

- Maximum ALE in identifiable current UK populations is 93.8 years (male)
- The population as a whole could reach this level within 100 years at typical industry-standard assumptions
- There has been a significant down-turn in improvements in the UK. It is uncertain both as to the cause and as to whether this will be sustained
- Is it reasonable for projections *not* to assert a research-based assumption of maximum longevity?
- In other words: should we move from the idea of a constant LTR to a gradually decreasing LTR – especially for deferred pension liabilities?
(NB different from tapering > age 85)

